

What is claimed is:

1. A composition comprising:
a metal-chelating ligand including a tetraazacyclododecane macrocycle ring
5 core, and
at least two non-identical substituents covalently bonded to the ring core,
wherein each of the at least two non-identical substituents contain a group capable
of binding to a cell receptor.
- 10 2. The composition of claim 1 wherein at least one of the non-identical
substituents is covalently bound to a ring nitrogen.
3. The composition of claim 1 or 2 wherein at least one of the non-
identical substituents is covalently bound to a ring carbon.
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4. The composition of any of claims 1-3 wherein at least one of the
non-identical substituents are covalently bound to the ring via an alkyl linking
group, an alkyl carbonyl linking group, or an alkyl amide linking group.
- 20 5. The composition of any of claims 1-4 wherein the
tetraazacyclododecane macrocycle ring core is chelated to a metal ion.
6. The composition of claim 5 wherein the metal ion is selected from
the group of metals consisting of: La, Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er,
25 Tm, Yb, Lu, Y, and Sc.
7. A composition comprising a metal-chelating ligand including
tetraazacyclododecane macrocycle having one or more alkyl carboxylic acids or
salts thereof appended to the ring nitrogen(s), and

a $\alpha_v\beta_3$ receptor binding ligand covalently bonded to a ring nitrogen of the metal-chelating ligand via an alkyl linking group, an alkyl carbonyl linking group, or an alkyl amide linking group.

5 8. The composition of claim 7 tetraazacyclododecane macrocycle includes two alkyl carboxylic acids or salts thereof each attached to one ring nitrogen.

10 9. The composition of claim 7 or 8 wherein the alkyl carboxylic acid is acetic acid.

15 10. The composition of any of claims 7-8 wherein the alkyl component of the alkyl carboxylic acid or salt thereof is a straight chain, a branched chain, cyclic or aromatic hydrocarbyl group having between 1-5 carbon atoms, and can be substituted with one or more of the following substituents, hydrogen, C1-C4 alkyl, C1-C4 branched alkyl or aromatic or heteroaromatic group or a combination of these groups.

20 11. The composition of any of claims 7 wherein the alkyl amide linking group is $-(CH_2)_nCO_2^-$ wherein n is selected to be between 1 and 6.

25 12. The composition of claim 7 wherein the alkyl component of the alkyl linking group, the alkyl carbonyl linking group and the alkyl amide linking group is $-(CH_2)_nCO_2^-$ wherein n is selected to be between 1 and 6.

30 13. The composition of claim 7 wherein the alkyl component of alkyl linking group, the alkyl carbonyl linking group and the alkyl amide linking group is a straight chain, a branched chain, cyclic or aromatic hydrocarbyl group having between 1-6 carbon atoms, and can be substituted with one or more of the following substituents, hydrogen, C1-C4 alkyl C1-C4 branched alkyl, aromatic, or heteroaromatic group.

14. The composition of any of claims 7-13 comprising a metal ion complexed to the tetraazacyclododecane macrocycle.

5 15. The composition of any of claims 7-14 wherein the metal ion is radioactive.

16. The composition of any of claims 1-15 wherein the metal ion is selected from the group consisting of: La, Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy,
10 Ho, Er, Tm, Yb, Lu, Y, and Sc.

17. A composition comprising:
a metal-chelating ligand including tetraazacyclododecane macrocycle having one or more alkyl carboxylic acids or salts thereof appended to the ring
15 nitrogen(s), and
a guanidine substituent covalently bonded to a ring nitrogen of the metal-chelating ligand via an alkyl linking group, an alkyl carbonyl linking group, or an alkyl amide linking group.

20 18. The composition of claim 17 wherein the alkyl component of the alkyl linking group, an alkyl carbonyl linking group or an alkyl amide linking group is a straight chain, a branched chain, cyclic and/or aromatic group.

19. The composition of any of claims 17-18 comprising a metal ion
25 complexed to the tetraazacyclododecane macrocycle.

20. The composition of any of claim 17-19 wherein the metal ion is radioactive.

21. The composition of any of claim 17-20 wherein the metal ion is selected from the group consisting of: La, Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, Y, and Sc.

5 22. A method of inhibiting tumor cell growth, said method comprising:
administering to the tumor cells an effective amount of a composition
including a compound having a metal-chelating ligand including
tetraazacyclododecane macrocycle having one or more alkyl carboxylic acids or
salts thereof appended to the ring nitrogen(s), and a $\alpha_v\beta_3$ receptor binding ligand
10 covalently bonded to a ring nitrogen of the metal-chelating ligand via an alkyl
group linking group, an alkyl carbonyl linking group, or an alkyl amide linking
group.

23. The method of claim 22 wherein the composition comprises a
15 radioactive metal ion chelated to the metal-chelating ligand.

24. The method of any of claims 22-23 wherein the tumor cell is
selected from the group consisting of osteosarcomas, neuroblastomas,
glioblastomas, melanomas, and carcinomas.

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25 25. A method of inhibiting tumor cell growth, said method comprising
administering to the cells a metal-chelating ligand including tetraazacyclododecane
macrocycle having one or more alkyl carboxylic acids or salts thereof appended to
the ring nitrogen(s), and
25 a guanidine substituent covalently bonded to a ring nitrogen of the metal-
chelating ligand via an alkyl linking group, an alkyl carbonyl linking group, or an
alkyl amide linking group.

26. The method of claim 25 wherein the composition comprises a
30 radioactive metal ion chelated to the metal-chelating ligand.

27. The method of any of claims 25-26 wherein the tumor cell is selected from the group consisting of osteosarcomas, neuroblastomas, glioblastomas, melanomas, and carcinomas.